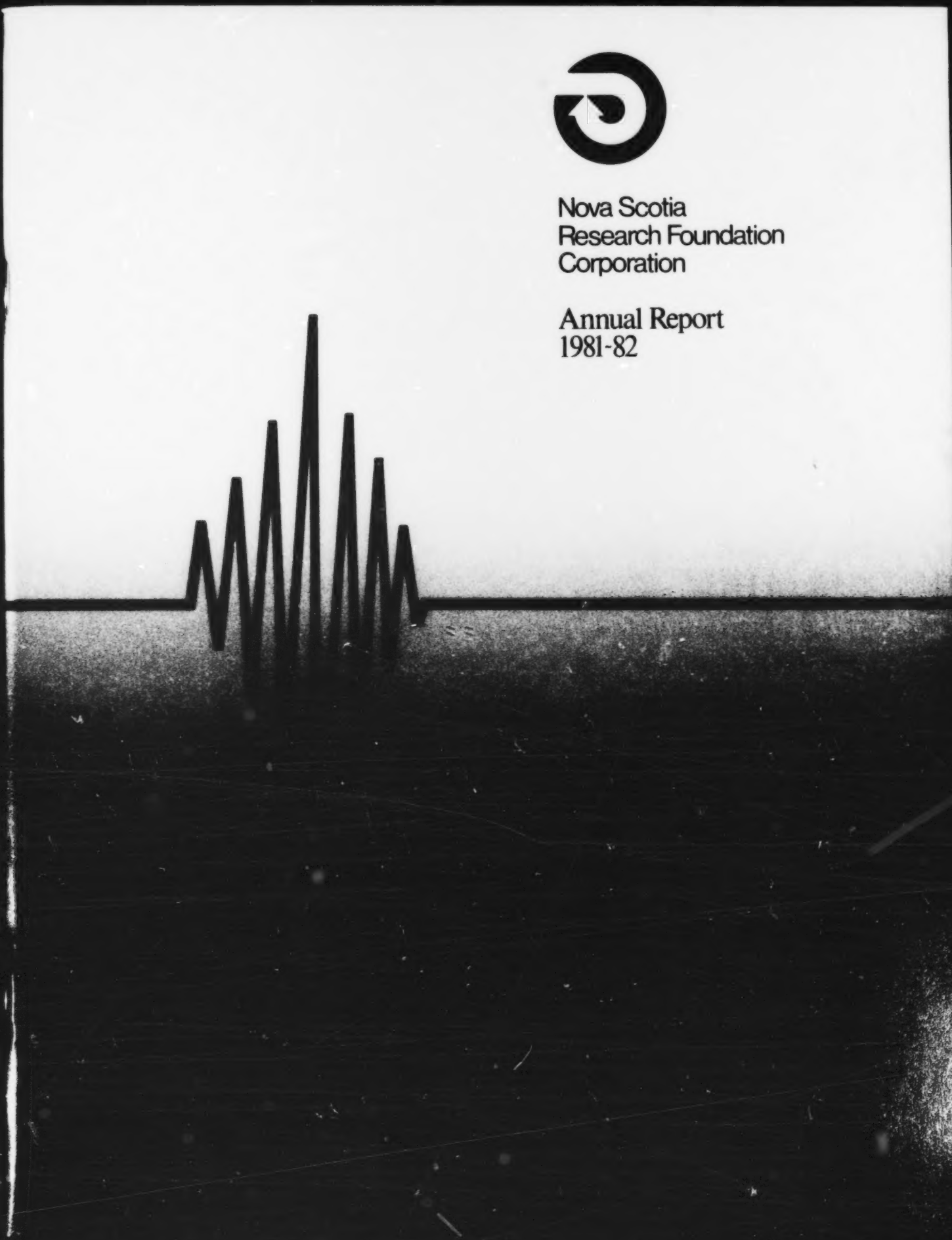

Nova Scotia Research Foundation Corporation

Annual Report 1981-82

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Printed in Nova Scotia

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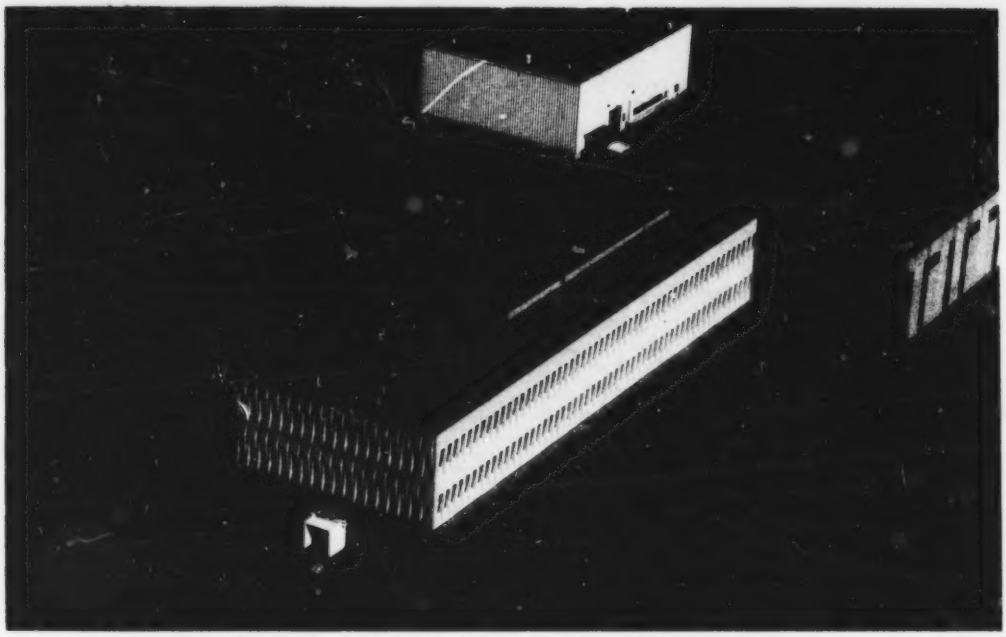

The Nova Scotia Research Foundation was established in 1946 by the Province of Nova Scotia to "assist in the economic development of Nova Scotia by promoting, stimulating, and encouraging the effective utilization of science and technology by industry and government." In 1975 the legislation was amended, changing the name to the Nova Scotia Research Foundation Corporation. This change recognized the predominantly industrial orientation of the Corporation and the fact that approximately two-thirds of the Corporation's income is derived from contract Research and Development activities.

The Corporation, wholly owned by the Province of Nova Scotia, is controlled by a Board of Directors representing Nova Scotia's industrial, scientific, and educational communities. The senior officers of the Corporation are Dr. J. E. Blanchard, President and Chief Executive Officer, and Mr. T. B. Nickerson, Vice-President and Secretary-Treasurer. The Corporation has a full time staff of 123 scientists, engineers, technicians, and support staff occupying a well-equipped 5,670 square metre laboratory building and a 560 square metre pilot plant on its four hectare Dartmouth site.

Five operating divisions — Industrial and Information Services, Chemistry, Biology, Geophysics, and Engineering Physics/Centre For Ocean Technology — carry out approximately 2,000 projects each year for 500 companies and government departments. Projects range from providing information to help a company solve an immediate technical problem to carrying out substantial research and development projects related to new industrial opportunities. The Corporation's activities can be grouped into two approximately equal parts —assisting industry in the solution of today's technical problems and developing new products/processes in response to tomorrow's opportunities. While the Corporation uses its capabilities to serve all sectors of Nova Scotia's industrial economy, particular emphasis is placed on technological support for the secondary manufacturing industry. The Corporation continues to emphasize the potential for ocean industry development in Nova Scotia.

The Corporation has assets of $7.6 million, including $4.1 million in buildings and equipment (valued at cost), 1981/82 revenues of $5.7 million represent an increase of 37 percent over 1980/81 and a compounded growth of 19.8 percent annually over the past decade. Contract Research and Development contributed 67 percent of total income; investment income, five percent; and a grant from the Province of Nova Scotia, 28 percent. The grant is used to assist small companies who need technological support but are not in a position to finance the support and to enable the Corporation to monitor new technological developments which may be of particular relevance to Nova Scotia.

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*Members of Executive Committee of the Board of Directors

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Honourable Roland J. Thornhill
Minister of Development
Province of Nova Scotia
Halifax, Nova Scotia

Sir:

I have the honour to submit the thirty-fifth Annual Report of the Nova Scotia Research Foundation Corporation.

Respectfully submitted,

J. E. Blanchard
President

Dartmouth, Nova Scotia
November 1, 1982

President's Report

While world and in particular Canadian economic conditions were deteriorating rapidly at year-end, fiscal year 1981/82 was a very successful year for the Nova Scotia Research Foundation Corporation. Led by a significant increase in contract revenues, total income grew 37% to $5.7 million. A major contributor to this growth was the Geophysics Division which became the first corporate division to generate annual income in sales of approximately $1,000,000. The success of the Corporation is the result of a dedicated staff and the interest and support of the Board of Directors. The Corporation is indeed grateful for this support.

The Corporation strengthened its capability to provide a broad range of technological support to Nova Scotia industry. During the year the Corporation undertook 1,000 technical assignments for Nova Scotia companies and responded to 1,600 requests for technical information. In several specialized areas of technology the Corporation established a worldwide reputation and, working with industry, was able to translate this technological leadership into commercial products and services which achieved annual export sales of approximately $1,000,000.

The Technical Information Services (TIS) expanded its engineering staff and opened an office in Sydney as a result of increased financial support from the National Research Council (NRC). NRC has reorganized the Industrial Assistance Program and TIS is now part of the Industrial Research Assistance Program (IRAP). It is gratifying to read the following statements by the Honourable John Roberts, Federal Minister of State for Science and Technology:

> *"We've done assessments . . . and the Technical Information Service shows a very good return for expenditure."*

The increased support of TIS (IRAP-C) came at a very opportune time. Industry has been experiencing a difficult period with shrinking markets and high interest rates. Many industries have been preoccupied with today's survival, leaving little time for consideration of tomorrow's new products. Technical Information and Industrial Engineering have helped a number of industries to survive. However, we must do more than strive for survival. We must constantly be concerned with the opportunities for new products and processes which will form the basis for success in tomorrow's marketplace.

The effective use of technology can contribute significantly to both the current survival and future growth of Nova Scotia industry. This is the object of the Corporation. The many strategies used to accomplish this objective may all be described as "technology transfer", the process of transferring scientific/technical knowledge from its source to a location where it can be applied to solve a problem, create a new product or process, or otherwise used to achieve some desired result.

Five of the Corporation's programs emphasizing technology transfer — Technical Information Service (IRAP-C), Applied Microelectronics Institute, Energy Test and Information Centre, Atlantic Group For Research In Industrial Minerals and Nova Magnetics Limited — are described elsewhere in this Annual Report. The Corporation's new product development programs and associated technology transfer are of particular interest at a time when technological innovation is recognized as one of the major generators of new employment.

Ten years ago the Corporation initiated a program emphasizing the development of ocean hardware as part of a provincial thrust to develop ocean industry in Nova Scotia. In addition to product development the Corporation's program included the establishment of a marketing program to identify user needs and to assist in initial market penetration of newly developed products. The results of this market-oriented product development program have been gratifying; the products developed have achieved international market acceptance and their success has resulted in further opportunities for new product development.

The transfer of this technology to industry is a continuing process which is proceeding satisfactorily, although not always as anticipated. Initially it was assumed that new products developed would be licensed to local industry which would carry out the manufacture, marketing and ongoing development functions. In practice the Corporation has frequently found that it has had to demonstrate successful innovation — development, manufacture and initial sales — in order to interest industry in manufacturing new products using new technologies and selling in new markets. With industry participating in sub-contract manufacture and other activities during the demonstration period, the industrial interest has developed, resulting in a significant growth in technology transfer.

Licensing agreements for wavestaffs, corrosive fluid detectors, automatic fishing machines and arsenic removal systems were concluded or nearing completion. In each of these agreements, the company participating was, or was close to, assuming complete responsibility for all aspects of the product.

The Corporation's electrical slip ring and fluid rotary union products, developed for the deep-sea diving industry, were licensed to a local company several years ago. When the licensee's business failed, for reasons not related to the products, the technology reverted to the Corporation. In order to maintain the product position in the marketplace it was decided to continue to supply the products through the Corporation. Component manufacture was contracted out to local firms with assembling, testing and marketing handled by the Corporation. This structure has worked efficiently for several years. If the strong sales growth of the past year is continued, and the potential for several new products

is realized, the product line may achieve a substantial dollar volume. Such a development should revive local industry interest in licensing agreements.

Nova Magnetics Limited (NML), a wholly-owned subsidiary of the Corporation, represents another approach to technology transfer. Several years ago the Corporation, in response to a need in the diving industry, developed a hyperbaric blower using a magnetic torque coupling to couple mechanical power from an external motor to an internal blower without using dynamic seals across the pressure vessel wall. This capability to produce "zero leak" gas circulators has considerable potential in a number of industries where leakage of gas into or out of a contained system cannot be tolerated. While a number of Nova Scotia companies expressed interest in the technology none was in a position to commit scarce financial resources to a new product line and new markets which, though holding considerable promise, had not yet generated any tangible benefit. In order to develop the market potential further, while providing a ready means to transfer the technology and developed markets to the private sector at the appropriate time, the Corporation established a wholly-owned subsidiary company to pursue this venture. When NML achieves significant success in the marketplace the company can be sold with its established products and markets. Each of these technology transfer methods evolved in response to a particular situation. Our experience would support the view that successful technology transfer mechanisms must be designed to meet individual situations. The mechanisms must reflect the reality that technology transfer is a very people-oriented process requiring the close cooperation of both the provider and receiver, and their joint recognition of the need and benefits of the technology transfer.

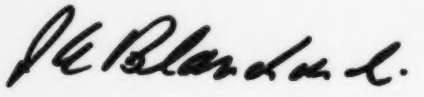
Official opening laboratory addition by Development Minister Roland J. Thornhill

Financing new technology and high technology industry has never been easy in Canada. Secondary industry has not been as attractive to Canadian investors as some other business investments. There is great competition for the investment dollar, brought about in part by tax concessions in the resource, motion picture and real estate industries. However, if we are to provide employment for our workers we must make our manufacturing industry more competitive. If industry is competitive in the marketplace with its products it will be attractive to the entrepreneur's investment dollar. With regard to creating new jobs, a recent study* has found that in the United States "large firms are no longer the major provider of new jobs for Americans. The most successful small firms result from high technology product innovation."

This suggests that in addition to tax incentives to encourage more R & D in existing firms the encouragement of new firms must have a high priority. Federal grants have been the principal means to encourage R & D in new firms in the past. The Province of Nova Scotia's Venture Capital Act provides for financial assistance to venture capital funds in the province. The allowance of income deductions for tax purposes to individuals who invest in R & D is the most recent incentive provided by the Federal Government. It is hoped that this will become a principal vehicle to support innovation in new firms.

No industrial sector has escaped the impact of the current economic recession. The Nova Scotia Research Foundation Corporation, providing technological support to a wide range of Nova Scotia companies and introducing new product innovations to world markets, is also experiencing the impact.

While the year ahead will be difficult, the constant need to improve industrial technology remains a challenge to be addressed with all available resources.



*"Who Creates Jobs", D. L. Brich, Public Interest No. 65, Fall 1981.

IRAP-C

This Field Advisory Service Program, sponsored in part by the National Research Council, provides technical assistance to small manufacturers within the Province. There is no charge for this service since one of its major objectives is to provide a quick and ready service to the small manufacturer.

During the year the program expanded from four to seven Field Engineers. In order to give industries located in Cape Breton a more rapid response to their technical inquiries, a Field Office has been located in the Adult Vocational Training Centre (AVTC) in Sydney. This enables the Field Officer to use the resources located on the College of Cape Breton campus to assist in answering technical inquiries.

The demand for the Industrial Engineering service led to an additional engineer made possible by the increased resources. A new responsibility for IRAP-C has been to promote NRC's Contribution Programs to industry. These programs, together with the Student program, are the responsibility of another engineer hired under the expanded program.

The increased use of the IRAP-C services by industry shows the effectiveness of this program as one method of technology transfer.

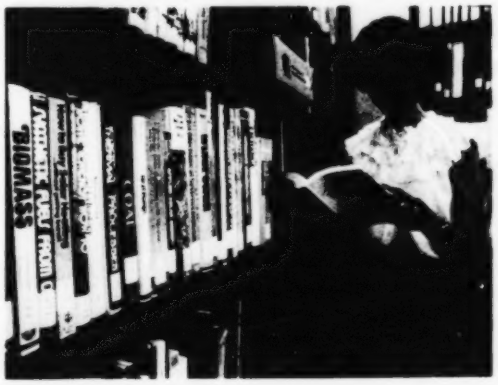
ENERTIC

During the latter half of the previous decade, as energy prices escalated and security of supply became uncertain, the need for more attention and awareness for energy matters became obvious. The Nova Scotia Research Foundation Corporation, the Technical University of Nova Scotia, and the Nova Scotia Department of Mines and Energy were pursuing separate initiatives in the energy field. Discussions between the parties, at the suggestion of the Nova Scotia Department of Mines and Energy, revealed a common interest and a mutual desire for co-operation.

The Canada/Nova Scotia Subsidiary Agreement on Energy Conservation, signed in 1978, provided a vehicle for the formal establishment of the Energy Test and Information Centre (ENERTIC) program. Through it, Nova Scotia industry and business have access to a specialized Technical Information Retrieval Service for energy questions through the Industrial and Information Services Division of the Nova Scotia Research Foundation Corporation, and a comprehensive combustion testing facility at the Centre for Energy Studies at the Technical University of Nova Scotia.

The main strength of the Information Service is that it provides local business access to worldwide information through resources held or accessed by ENERTIC. ENERTIC staff are able to locate this information through an in-house data base, commercially available data bases, knowledge of various research and development activities of other Canadian institutions, and the library system. Provision of this service allows business management to concentrate its efforts on solving new problems, rather than on re-inventing solutions to problems previously solved elsewhere.

The increasing use of the ENERTIC Information Service during its first full year of operation clearly demonstrated the need for such a program.

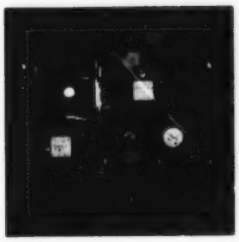


Nova Magnetics Limited

The Nova Scotia Research Foundation Corporation has incorporated a wholly owned subsidiary company, Nova Magnetics Limited (NML), to pursue the business opportunity arising from the Corporation's technology in Magnetic Torque Couplers. These developments stem from work within the Engineering Physics/Centre For Ocean Technology. Division over the past four years. The Corporation's objective, once the commercial viability of the opportunity is established, is to sell NML to the private sector as an on-going business, thus completing the desired

technology transfer, without loss of corporate identity during the transfer process.

Nova Magnetics Limited has currently in its inventory a range of magnetically coupled blower products which meet some of the needs of the commercial diving, nuclear and chemical industries. The specific features of these blowers all relate to the "zero leakage" capability achieved by magnetically coupling mechanical power through a metallic barrier into the sealed blower. The Corporation has licensed to NML its technology relating to self-cooled magnetic drives. These drives are protected under a number of Canadian and foreign patents.

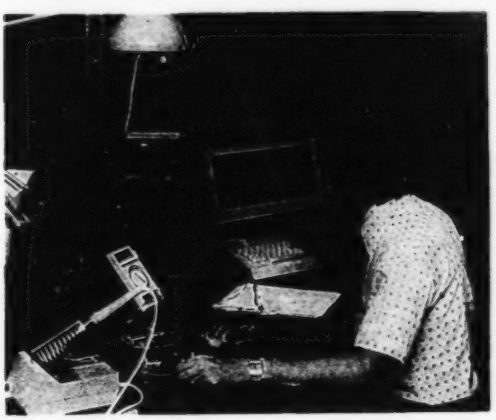


Nova Magnetics Limited will manufacture and market the proven NSRFC designs. The Corporation will continue to explore new development opportunities using this technology.

Applied Microelectronics Institute

In September 1981 the Nova Scotia Research Foundation Corporation, Dalhousie University and the Technical University of Nova Scotia jointly established the Applied Microelectronics Institute (AMI). AMI brings together the major microelectronics R & D activities of the three sponsoring institutions and uses this combined capability to assist and encourage the industrial application of microelectronics in the region. AMI is expected to become one of a number of microelectronic centres in Canada with support from the Federal Government's Microelectronics Support Program.
The principal activities of AMI are:

Research and Development —
Emphasis on the development of innovative marine and medical products which can be manufactured in the Atlantic region.



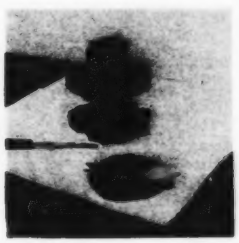
Resource Centre For Industry—
Assistance in microelectronic applications and the provision of facilities for the evaluation of new technologies.

Education—
Short courses for industry and provision of opportunity for university researchers and graduate students to participate in an applications-oriented environment.

AGRIM

Collaboration With The Atlantic Group For Research In Industrial Metallurgy

The Atlantic Group For Research In Industrial Metallurgy (AGRIM) came into existence in 1975 and included scientists and engineers from the Nova Scotia Research Foundation Corporation, Atlantic Regional Laboratory (NRC), Dalhousie University, Technical University of Nova Scotia, St. Francis Xavier University, College of Cape Breton, New Brunswick Research and Productivity Council and the Sydney Steel Corporation (SYSCO).



The initial research by this group was funded through an IRAP grant to SYSCO and was concerned with the problem of sulphur in steel, which related directly to sulphur in coke. More recent work by AGRIM is concerned with the desulphurization of thermal coal, and with pyrolysis of eastern Canadian coals to skim off easily-recoverable tars, oils and gases. In this work, NSRFC has had success with their approach of pyrolyzing high sulphur coal intermixed with lime. The resulting char is low in sulphur (less than 1%). Most of the sulphur is recovered as elemental sulphur, and the volatized hydrocarbons (liquids and gases) can be sources of feedstock for secondary industry.

Collarboration with NRC (Halifax) on developing a slip-cast ceramic burner nozzle for coal-liquid mixtures shows promise of solution to the problem of nozzle erosion during combustion of these mixtures.

Industrial and Information Services

The Industrial and Information Services Division's primary task is to provide free technical assistance to small secondary manufacturing and processing industries. The principal program available to small industries is the IRAP-C (Field Advisory Service) program. The National Research Council (NRC) supplies major funding for this program under a contract with the Corporation. The Division has two contract groups — Project Services and Operational Research — and administers the Corporation's technical library.

Research & Development

A school bus routing technique is currently being investigated by the Operational Research Group. If adaptable to Nova Scotia, this could result in savings to local school boards by providing them with the most economic routing and use of school buses.

The IRAP Field Advisory Service and the Operational Research Group are encouraging the use of microcomputers by small businesses. Because of the wide variety of systems and programs available, the groups are working to assist businesses in the selection of those most suitable to their needs.

Problem Solving

IRAP-C, Field Advisory Service

This program assists small industry in solving technical problems and in adapting new and improved methods to increase efficiency. The service now includes a field office near Sydney, Cape Breton.

IRAP-C is divided into three parts:

- **Technical Inquiries**

The staff consists of three engineers and a technician. During the year: 1,614 inquiries resulted from 1,375 contacts, of which 838 were field calls.

Typical subjects: packaging problems, information with regard to specifications, corrosion and its many related problems, possible new products and the use of new equipment to improve operations.

- **Industrial Engineering**

This section assists companies through the installation of new and improved methods, costing, cost controls and analyzing their operations to improve productivity. An engineer works with the client to diagnose the problem, and analyze various improvements to make the most appropriate recommendation to the problem in hand. The three industrial engineers undertook 72 new projects during the year.

- **Programs**

The Division is now responsible for encouraging the use of NRC's contribution programs. An engineer assists industries in their program applications. Approvals were received for nine of the 15 applications for various IRAP programs by year end. The Scientific and Engineering Student Program (SESP) placed 21 students in 19 industries.

Project Services

Energy related activities included the Ener$ave Consulting Follow-Up Program carried out in conjunction with the Nova Scotia Department of Mines and Energy. The Information Service of the Energy Test and Information Centre (ENERTIC) answered 137 inquiries demonstrating increased use by industry and consultants. A General Manager was hired for the ENERTIC program to coordinate the Test Services and Information Services.

Marketing and feasibility studies were completed for a variety of organizations. Results of these studies enabled the clients to make sound business decisions regarding new products or new plants.

Operational Research

The group provided mathematical modelling or computer techniques for a fishing vessel information system, an on-line information storage and retrieval system for ENERTIC, the IRAP Information Retrieval System, and the coal marketing model.

Technical Library

The Library responds to the scientific and technical literature needs of the Corporation staff. Increased use of on-line databases resulted in faster responses to requests and provided access to more sources of information.

Services

IRAP-C, Field Advisory Service; Industrial Engineering
Assistance to small secondary manufacturers in the diagnosis and solution of plant problems using economic, operational and statistical analyses. Assistance in implementing improved methods, production processes, controls and procedures.

IRAP-C, Field Advisory Service; Technical Inquiries
Assistance to industry in identifying and solving problems relating to materials, processes and equipment by using the available technical literature, assistance in its interpretation and adaptation to the problem. Background information on technical subjects.

IRAP-C, Programs
Advice is provided to companies wishing to access NRC programs. Assistance is furnished to develop a suitable project and prepare program applications. Advice on the applicability of the various projects to these programs is also furnished.

Feasibility Studies
Industrial feasibility studies consisting of technical, economic and market analyses related to specific industrial opportunities.

Plant Facilities Analysis
Plant layout and materials flow analysis for new or existing facilities, including evaluation of materials handling and production equipment and improvements thereto.

Project Industrial Engineering
Technical feasibility and economic studies of current, improved and new industrial operations; and plant assessment, providing an industrial engineering staff function to small companies.

Optimal Allocation Problems
Solution to scheduling, routing, allocation, blending and mixing problems using mathematical methods.

Mathematicald Modelling
Development of econometric and other mathematical models to assist planners and decision-makers in evaluating the impact of alternative policies.

Information Reporting Systems
Design and implementation of manual and computer-based information and reporting systems.

Library Services
Availability of 11,000 books, periodicals and pamphlets on scientific and technical subjects through inter-library loan and/or direct borrowing where applicable. Literature searches on technical subjects, both manually and by computer.

Staff

Director
J. R. Helliwell,
A.C.S.M. (Camborne), P. Eng.

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M.I. M.E., (R.N.E.C.), P.Eng.
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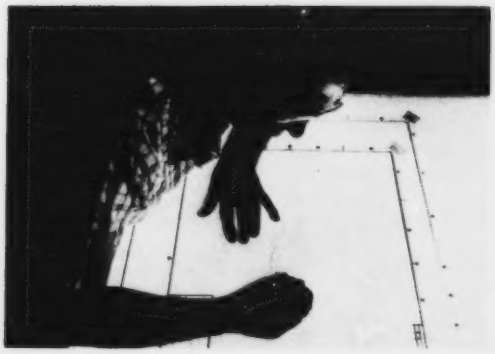
H.A. Kornuta,
B.A. (Concordia)
M. C. MacDonald,
B.A. (Dal., Kings)
C. L. O'Connell
J. L. Stewart
M. W. Veling, B.Sc. (Dal.)

*Project Leader

Geophysics Division

The Geophysics Division provides expertise in the design, development and production of marine geophysical equipment for offshore engineering investigations. A wide range of marine and ground geophysical services are offered using Geophysics Division equipment and personnel. These services include geophysical surveys, data reduction, interpretation and consultation.



Research & Development

A gravity investigation of the faulted coal-bearing Stellarton-Thorburn sedimentary basin, funded by a Department of Energy, Mines and Resources Research Agreement, was undertaken using summer students trained by Geophysics Division personnel. Data reduction and interpretation of the results are to be continued in 1982.

A member of the Geophysics Division worked with the Geological Survey of Canada in the Beaufort Sea using the NSRFC 12-channel seismic streamer to study ice-bonded sediments beneath the seabed.

Marine geophysics equipment development centred on the improvement of the sidescan sonar system for use with the NSRFC Deep Towed Sub-Bottom Profiling System.

Problem Solving

A NSRFC Deep Towed Sub-Bottom Profiling System was sold to a major Canadian Engineering Company early in 1982. Client operators were trained in the use of the system. NSRFC seismic streamers were sold to both industry and government organizations.

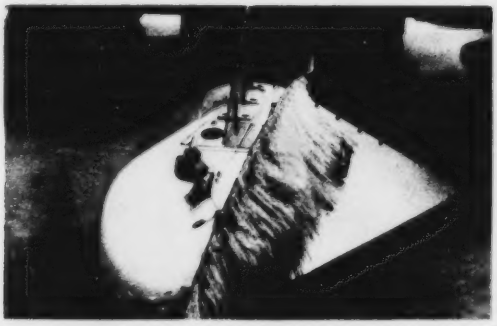
Extensive marine seismic surveys were carried out to detect sand and gravel deposits in the Beaufort Sea for construction of artificial islands for oil and gas exploration; to survey oil pipeline routes in Lake Erie and the Ottawa River; and for drilling rig sites off Newfoundland. Other marine seismic work included surveys for the Fundy Tidal Power Pilot Project, a mining engineering investigation in a Manitoba lake, the delineation of underwater gold placer deposits off the cost of Nova Scotia, a pipeline study in Saint John Harbour and detection of soft underwater sediments for dredging in the Yarmouth area. The sidescan sonar system was used with great success on several engineering projects.

A number of gravity surveys and interpretation projects were completed over areas in Nova Scotia and New Brunswick for potash exploration. Other gravity projects included surveys for base metals and mineral exploration in Cape Breton and mainland Nova Scotia and gravity measurements on the frozen surface of Lake Bras D'Or for oil and gas exploration.

Shallow seismic projects on land measured bedrock depths for solid waste disposal and housing development sites.

Seismic velocities were measured for rippability studies on a mine site in Nova Scotia.

Geophysical borehole logging in coal exploration holes continued in various parts of mainland Nova Scotia and Cape Breton.



Deep tow V-fin and faired cable

Deep tow winch

Services

Bore Hole Logging
Measurements of spontaneous potential, resistance, total natural gamma radiation, hole diameter and scattered gamma (density), including bed resolution capability for coal seam logging, to depths of 2,000 metres.

Sub-Bottom Profiling
High resolution, deep and shallow towed sub-bottom seismic profiling surveys in water depths from 1 metre to 1,000 metres for rig site surveys, pipeline routes, iceberg scours, pockmarks, regional surficial sediment surveys, dredging surveys, cable crossings, harbour facilities, outfall pipes, tanker terminals, etc. Side scan sonar and depth sounder surveys complement sub-bottom profiling.

Mineral Surveys
Gravity, magnetic, induced polarization, electromagnetic, resistivity, shallow seismic and bore hole logging surveys used in the search for salt, potash, uranium, coal, celestite, barite gypsum, base metals and other minerals.

Land Seismics
Seismic surveys to determine depth to bedrock and nature of overlying material for civil engineering studies on potential dam sites, waste disposal sites, gravel deposits, etc.

Maps
Tectonic, drainage, Bouguer gravity and topographic maps of Nova Scotia on various scales.

Staff

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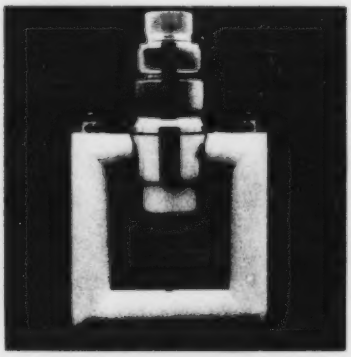
Land Geophysics
K. Howells,
B.Sc. (Wales), Ph.D. (Cantab.)

Technical and Support
P. A. Beech
E. D. Clarke
D. J. Doucett
R. H. Edsall
D. F. Hornsby
G. L. Melling
F. M. Smith
L. G. Tufts
G. P. Woodgate



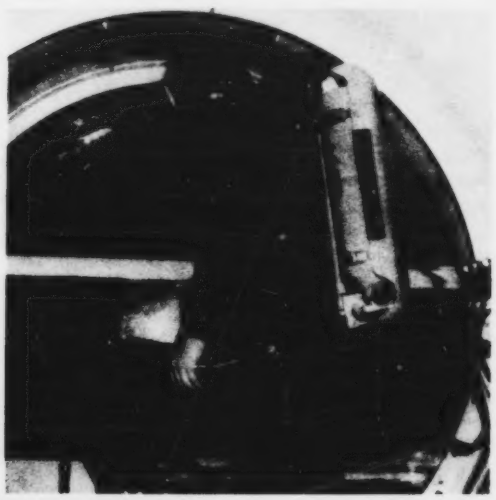
Single tip sparker for deep tow system

Engineering Physics and the Centre for Ocean Technology

The electronic and mechanical engineering design skills of the Division are used to support and encourage the development of specialized industrial hardware which can be manufactured in Nova Scotia for domestic and export markets. The Centre For Ocean Technology, which was originally funded in part by the Federal Department of Industry, Trade and Commerce, emphasizes development of ocean hardware, a particular opportunity for Atlantic Canada.

Research & Development

Underwater Breathing System
The Division continued its design and development activity with the Defence and Civil Institute of Environmental Medicine (DCIEM) in Toronto towards the completion of a new underwater breathing system. Trials of the prototype units have been successful with manned dives in the DCIEM deep-dive facility, proving performance of the oxygen control system. The prototypes passed tests in the United Kingdom where automated breathing resistances tests were performed to the full operating depth of the system. Further contracts to complete an advanced development model are expected in mid 1982.



Testing Underwater Breathing Apparatus.

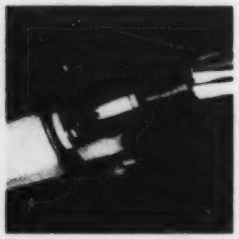
Data Acquisition
The combination of electronic engineering and ocean technology expertise of the Division resulted in the development of a number of new underwater data acquisition systems. These systems have been used by Dalhousie University, the Bedford Institute of Oceanography and the British Admirality Marine Technology Establishment to provide multiplexed data from submerged instrumentation. The success of this development illustrates the benefits of cooperative interaction between the Corporation, Dalhousie University and the Bedford Institute.

Magnetic Drives
The Division's patented "magnetic drive technology" continued to find new applications. Developed originally to meet a need for reliable, ultra low leakage circulation of breathing gases at high pressure in the Canadian diving research program, the technology has found application in similar fields in other countries. The technology is now being used to solve problems of circulation of explosive and/or toxic gases in the chemical and nuclear industries. A number of related patents on this technology have been issued to the Corporation. Product sales incorporating these drives have been achieved in Canada, U.S.A., U.K., Germany and Norway.

This technology has now been transferred to Nova Magnetics Limited (NML) for commercial exploitation. NML is a wholly owned subsidiary of the Corporation. The objective of establishing NML was to transfer the commercially successful magnetic coupling technology to the private sector as part of an operating company, rather than piecemeal in specific designs.

Problem Solving

The Division used its ocean-oriented electronic and mechanical engineering skills to assist industry and individuals in a variety of problem assignments. Services included assistance to inventors in technical problems relating to patent applications, industrial problem solving and design services and provision of specialized industrial measurement capabilities.



Electrical Slipring.

Services

Advisory Services
Engineering services to industry on matters concerning equipment operating in a marine environment.

Engineering Support
Design team service on a subcontract basis to enhance prime contractor engineering capabilities.

Product Development
Ocean-oriented product design and development on a contract, royalty or venture engineering basis. Development or modification of instruments to meet measurement needs in fields of biology, chemistry, geophysics and oceanography.

Industrial Measurement
The Division provides a wide range of measurement capability for physical parameters. Services include instrument rentals, field measurements and data analysis.

Indoor lighting environment surveys covering both intensity and spectrum. Transmission measurement of translucent materials. Noise surveys, indoor and outdoor. Recording and spectral correlation analysis of sounds. Technical assistance with community and industrial noise problems.

Microprocessor Services
The microprocessor design activity of the Division has been transferred to the newly formed Applied Microelectronics Institute (AMI). AMI is a joint venture of the Corporation, Dalhousie University and the Technical University of Nova Scotia.

Staff

Director
C. R. Tyner,
H.N.C. (Denbighshire), P.Eng.

Professional
Electronic Engineering
J. Osborne,
B.Sc., A.R.C.S., P.Eng.
A. G. Jost,
B.Sc., M.Sc., Ph.D. (Dal).
Mechanical Engineering
E. A. Smallhorn,
B.Eng. (McGill), P.Eng.
W. W. Spencer,
M.Eng., (T.U.N.S.), P.Eng.

Technical & Support
E. C. Chesal
C. Dickinson
J. Edwards
H. G. James
W. Mills
R. G. Morash,
B.Sc. (Eng. Physc.) (Dal.)
J. B. Oliver
N. P. Richter,
B.Eng. (S.M.U., N.S.T.C.)
R. Warnell

Chemistry Division

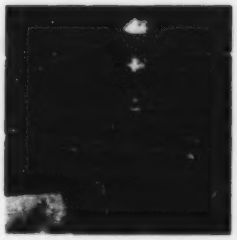
The Chemistry Division undertakes chemical and chemical engineering research and development and problem solving for industry and government in Nova Scotia in response to existing problems and future opportunities. Process innovation and product improvement related to the utilization of the Province's natural resource form a major part of the work of the Division.

Research & Development

Removal of Arsenic and Uranium
The well water arsenic removal equipment designed and developed by the Corporation and approved by the Nova Scotia Board of Health is to be licensed for manufacture by a local water treatment company.

A process has been devised and the initial laboratory testing completed for the removal of uranium from well waters to meet Canadian Drinking Water Standards. A protracted testing program will be undertaken to validate the initial promising results and to optimize the equipment.

Food Research
Agriculture Canada supported a program to investigate the process parameters necessary to produce a market-acceptable chicken chip using deboned chicken meat. The application of ultracentrifugation recovers the protein from fat and water phases of this meat. The project is nearing completion with preliminary samples showing much promise.



Coal Liquefaction
Coal occupied a significant part of the overall R & D program. Coal liquefaction studies continued with particular emphasis on restructuring the extraction reactor from a column-flow to a stirred autoclave mode of the coal-solvent slurry. Associated with this restructuring was an expansion in the quantity and quality of the instrumentation for characterizing and quantifying the coal-liquid product. At the same time, a study of catalysts suitable for coal extraction in the coal-solvent slurry was pursued. The equipment in our pilot plant was used to measure the applicability of approximately fifteen coals for liquefaction. This information was required for the Scotia Coal Synfuels Project.

Coal Desulphurization
Continuing efforts directed towards chemical desulphurization of high sulphur coals comprised projects in pyrolysis and in oxy-desulphurization. Rapid heating of coal-lime mixtures resulted in a Prince Mine coal containing four percent total sulphur, producing a char of less than one percent sulphur. Tars, coal chemicals and gases are recovered. Elemental sulphur is also a by-product.

Desulphurization of coal by heating a stirred water slurry in an air temperature of 150°C, and pressure of 250 psig, can reduce the total sulphur content by 70 percent. The use of limestone to neutralize the acid produced indicated that any contamination with magnesium (most limestones in Nova Scotia contain magnesium) drastically restricts the degree of oxidation. Recent work at the corporation has eliminated this difficulty so that it is now possible to use dolomite as the acid neutralizer. An eight percent sulphur coal was reduced to two percent sulphur by this process.

Corrosion Studies
A fundamental study continued on the dealuminification of A1-Si bronze for the Defence Research Establishment (Atlantic), with positive results occurring from the heat treatment approach to the problem.

Problem Solving

Industrial Trace Analysis Group is providing services for the heavy water industry of the province for antifoam analysis, as well as antifoam reactivity and stability under G-S process conditions. A microcomputer was integrated with liquid chromatography equipment, resulting in greater speed and accuracy in data output. Trace organic analysis was also used for public water systems studies.

The ***Gamma Scanning Service*** used at the heavy water plants to assist in optimizing conditions in the gas-liquid exchange towers was also successfully applied to the solution of problems in oil refinery towers. This scanning application promises to offer benefits to the petroleum and chemical industries.

Growth in ***Metallurgical Assistance to industry*** and particularly the marine industry reflects the increasing offshore activities. Several additions were made to the metallurgical measuring equipment.

Phase One of an ***Air Pollution Study*** of the Halifax-Dartmouth area was undertaken in collaboration with the Ontario Research Foundation. The Ontario Research Foundation's extensive experience in air pollution measurements expedited completion of this phase of a long-term program.

Services

Analytical Services
Inorganic and organic analyses of gases, liquids and solids using both classical and modern instrumental methods — organic compound identification by means of gas chromatography, gas chromatography/mass spectrometry, liquid chromatography and infrared, ultraviolet and visible spectrophotometry — analysis and identification of ores and metals utilizing atomic absorption, emission spectrograph and x-ray fluorescence and diffraction equipment.

Chemical Engineering
Cost analysis, process development, process feasibility and engineering design — studies of coal liquefaction and sulphur removal from coal.

Corrosion Control
Identification and solution of industrial problems related to corrosion.

Effluents
Investigation into methods for reduction in Biological Oxygen Demand (BOD), suspended solids, colour and toxicity in industrial waste waters.

Foliar Analysis
Determination of nutrient needs in fields and greenhouse crops by spectrochemical analysis of plant leaves.

Food Analysis
Identification and solution of problems related to food purity and stability — analysis of food products for conformation to the Food and Drug Act. Chemical and biological studies related to the development of new food products.

Gamma Scanning
Gamma scanning of process towers, such as those in heavy water and other chemical plants, to determine liquid-vapour distribution inside operating towers. Towers up to 8.5 m (28 feet) in diameter and 90 mm (3.5 inches) wall thickness can be scanned using a 10-curie cobalt-60 gamma-ray source.

Industrial Chemistry
Chemical investigations to develop new processes for the greater utilization of natural resources and the development of new products for the resource-based industries of Nova Scotia.

Spectrograph Services
Direct reader and photographic emission spectrograph for semi-quantitative analysis of metals, ores, corrosion products, foilage, fuel ash, etc.

Thermal Analysis
Utilizing the Stone DTA and TGA equipment, endothermic and exothermic data due to phase change or decomposition are evaluated. Weight losses versus temperature up to 1500°C are recorded.

Staff

Director
J. A. Brothers,
B.Sc. (St. F.X.), M.Sc. (Dal.)

Professional
Analytical Services
M. J. Firth
G. D. Lutwick,
B.Sc., M.Sc. (Dal.), Ph.D. (Alta.)
Corrosion Research & Services
T. Betancourt,
B.Eng. (S.V.S.T.), M.Eng. (T.U.N.S.)
P.Eng.
A. Kazi,
B.Sc. Eng. (Dacca), M.Eng. (McMaster), Ph.D. (T.U.N.S.), P.Eng.
Coal Conversion
D. Jay,
B.Sc. (Queen's), P.Eng.
J. K. LeDue,
B.Sc. (Dal.)
J. J. Starzomski,
B.Sc. (St. F.X.)
Gamma Scanning
B. Rapson,
B.Sc., M.Sc. (Queen's), P.Eng.
Environmental Chemistry
A. L. Crandlemire,
B.Sc. (Mt. A.)
Heavy Water Plants —Analytical Services
J. W. Thrope,
B.Sc., M.Sc. (Acadia), Ph.D. (McMaster)
Food Chemistry
M. H. Chahine,
B.Sc. (Cairo), M.Sc., Ph.D. (Illinois)

Technical & Support
M. H. Bacon
H. F. Ballum
P. C. Berube
R. K. Boss,
B.Sc. (Mt. A)
S. R. Cash,
B.E.M. (Civil), B.Sc. (M.S.V.)
W. E. Dearman,
B.Sc. (Dal.)
L. D. Giffin,
B.Sc. (S.M.U.)
W. R. Gillis,
B.Sc. (S.M.U.)
R. G. Mombourquette
J. E. Mosher,
B.Sc. (Dal.)
M. L. Robicheau,
B.Sc. (Dal.)
R. E. Skinner,
B.Sc. (Dal.)
D. B. Smith,
B.Sc. (Acadia)
H. E. Stillman,
B.Sc. (Dal.)
S. G. Thomas
R. W. Tizzard,
B.Sc . (Dal.)

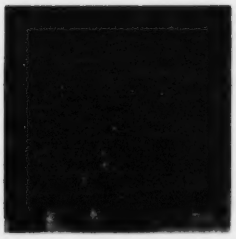
Biology Division

The Biology Division emphasizes research and development related to fermentation and microbial technology. The work of the Division includes the development of biological products and processes as well as the provision of biological services to industry and government.

Research & Development

Fungal Fermentation of Lignocellulosic Materials
Fermented wood and straw prepared during the previous year underwent further testing and evaluation at the Agriculture Canada Research Station in Fredericton. Fermented straw shows promise as a ruminant feed. Further research into the optimization of the fermentation process is planned during the next year.

Microbial Enzymes
The Division is interested in using fermentation methods to generate biological products of high value such as enzymes or biochemicals. Work continued on the development of methods for the production of microbial lipase, an enzyme used to determine serum triglycerides for diagnostic purposes. Research focused on the selection of bacterial strains with high lipase production, on the optimization of fermentation methods and on suitable procedures for the recovery and purification of the enzyme.



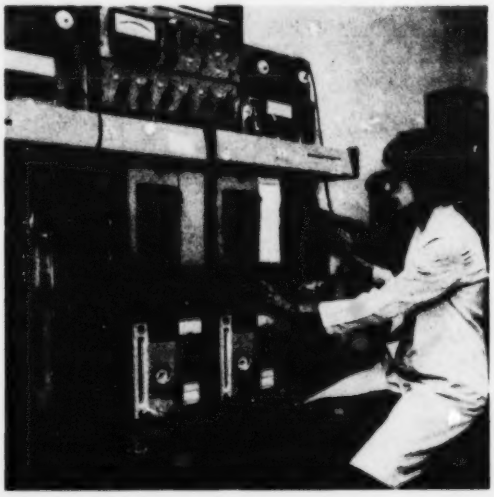
Mycorrhizal Fungi
Fungi associated with plant roots, forming so called mycorrhizae, are known to be beneficial to forest trees as well as to agricultural crops. There is evidence that these symbiotic associations aid in the uptake of nutrients by the plant and in the protection against soil-borne diseases.

During the past year, a number of fungi associated with spruce trees were isolated, identified and grown in laboratory cultures. The aim of the work is to inoculate container-grown spruce seedlings with suitable mycorrhizal fungi to improve their growth and survival after outplanting.

Pollution Indicators in the Marine Environment
There is evidence that micro-organisms traditionally used as pollution indicators in water are less reliable in seawater than in freshwater. For this reason a study was undertaken in polluted and unpolluted areas along the Northumberland Strait to assess potential alternative indicator organisms.

Densities of *Candida albicans, Pseudomonas aeruginosa* and *Vibrio paraphaemolyticus* corresponded well with densities of common indicator bacteria and appeared to survive longer than such bacteria in seawater. It was concluded that in marine recreational and shellfish waters, these three pathogens could complement fecal coliforms and fecal streptococci as indicators of human fecal contamination.

Problem Solving



The Division provided services to an increasing number of local companies in the fields of food and water microbiology and aquatic toxicity. Fresh fish and shellfish, canned or frozen foods, beverages, bakery products and confectionery were examined for the presence of pathogenic and non-pathogenic bacteria, yeasts and mold. Bacterial examinations were conducted on water supplies and waste waters. A comprehensive study dealt with the possibility of bacterial contamination of domestic water filters. Various industrial effluents were tested for the presence of toxic materials, using rainbow trout as the standard bioassay organism.

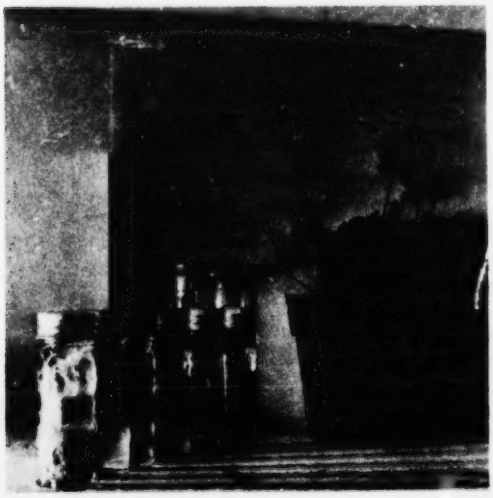
Services

Effluent Toxicity
Standard fish bioassays for monitoring toxicity of industrial effluents.

Food Microbiology
Quality control and analysis of foodstuffs, with respect to pathogenic and other micro-organisms. Testing for toxic metabolites such as aflatoxins or other mycotoxins produced by micro-organisms in food and feedstuffs.

Environmental Microbiology
Microbiological studies in freshwaster, marine and terrestial environments.

Fermentation Research
Investigation into the use of micro-organisms for the conversion of low-cost substrates or wastes into microbial biomass or useful metabolites.

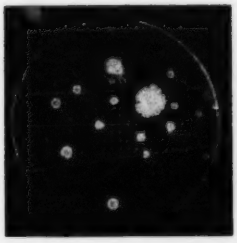


Staff

Director
K. E. Hellenbrand,
Ph.D. (Gottingen)

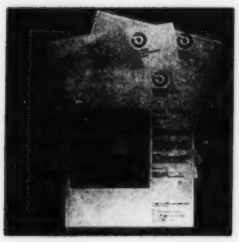
Professional
Fermentation, Food and Industrial Microbiology
A. E. Reade,
B.Tech. (Brunel), Ph.D. (Aberdeen)
Plant Physiology, Plant-Microbe Interactions
C. D. Boyle,
B. A., B.Sc. (Queen's), M.Sc. (Dal.)
Environmental Microbiology, Nitrogen Fixation
W. J. Robertson,
B.Sc. (Dal.)

Technical and Support
J. M. Colpitts
J. E. Dickie,
B.Sc. (Mt. A.)
C. L. Graham,
B.Sc. (Mt. A.)
K. E. Spencer,
B.Sc. (P.S.U.)



Marketing & Ocean Technology Production

Marketing



Nova Scotia Research Foundation Corporation Marketing fulfills three objectives — maintains Nova Scotia's engineering image in the world marketplace, sells existing hardware manufactured by local industry in conjunction with the Corporation, and identifies unsatisfied needs which may represent future new product opportunities.

These objectives were achieved by participation in offshore trade shows in Halifax, Aberdeen, Brighton and New Orleans; advertising in trade journals in Europe and North America; customer visits and the appointment of representatives in Denmark, Germany, Belgium, France and the United Kingdom. These representatives include:

MacArtney ApS (Scandavia)
Esbjerg, Denmark

J. Bornhoft Industriegerate (Germany, Australia, Switzerland)
Keil, Germany

Techmation (Belgium, Luxembourg)
Brussels, Belgium

Nereides (France)
Paris, France

Tamtech Limited (U.K. and Ireland)
Aberdeen, Scotland

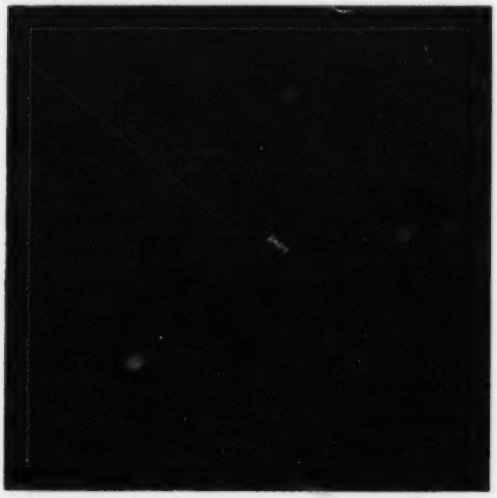
Sales of the Corporation developed hardware during the year exceeded $1,000,000 for the first time. Eighty percent of the sales were made to export markets. The penetration of new markets and the ongoing introduction of new products should enable the Corporation to achieve a substantial sales growth in the next few years if world-wide economic conditions recover soon from the current recession.

Head of Marketing
J. A. Gillis,
B.Sc. (St. F.X.), B.Ed. (S.M.U.), M.B.A. (Dal.)

Support
J. P. Fredericks

Ocean Technology Production

Ocean Technology Production (OTP) coordinates the assembly, testing and quality control of the Nova Scotia Research Foundation Corporation's electrical slip ring, fluid rotary union and wavestaff products. Component manufacture for these products is contracted out to local industry. Engineering and R & D are provided by the Corporation's Centre For Ocean Technology. Product marketing and sales are handled by the Corporation's Marketing Group.



129 circuit electrical slipring.

Sales of electrical slip rings, fluid rotary unions and wavestaffs totalled $360,000 during the year, a fourfold increase over the previous year. Ninety-five percent of sales were for export markets. The high world-wide level of offshore diving and remote controlled submersible activity and the introduction early in the year of a new modular electrical slip ring design contributed to the growth. At year end several new product developments were initiated which, when completed, should further broaden the marketplace for OTP products.

A licensing agreement for the Corporation's wavestaff was signed with Orion Electronics Limited of Saulnierville, Digby County. Orion Electronics will now manufacture and market all wavestaffs.

Head of OTP
P. M. Baker

Nova Magnetics Limited

In May 1981 the Nova Scotia Research Foundation Corporation incorporated a wholly owned subsidiary, Nova Magnetics Limited (NML), to pursue the business opportunities arising from the Corporation's technological developments in magnetic couplings. The Corporation's objective, once the commercial viability of the opportunity is established, is to sell Nova Magnetics to the private sector as an on-going business, thus completing the desired technology transfer.

Over the past two years the Corporation has undertaken technology development and market identification for "zero leakage" magnetically coupled blowers. Over that period the Corporation has achieved the development, manufacture and sale of over $400,000 worth of magnetically coupled hardware for export markets. While present sales are custom-engineered units for special applications, there are growing indications that a market is emerging for a range of standardized "zero leakage" gas circulators using NSRFC magnetic coupling technology.

The business opportunity in magnetically coupled blowers has been explored extensively with companies in Nova Scotia. However, all of the companies approached concluded that, while the opportunity was interesting, their limited human and financial resources were needed for the growth of existing businesses. The Corporation's conclusion was that exploitation of this technology could best be achieved by establishing a subsidiary company, Nova Magnetics Limited, to carry out the manufacture and sales of developed hardware while the Corporation concentrates on continued technological development and design of new hardware to meet user needs.

The objective of Nova Magnetics Limited is to develop a profitable business based on the magnetically coupled products developed by the Corporation.

The Nova Magnetics Board of Directors are:
Dr. J. E. Blanchard
President, NSRFC
Mr. T. B. Nickerson
Vice-President, NSRFC
Mr. P. M. Taiani
Associate Research Officer, NSRFC
Mr. C. R. Tyner
Director of Engineering Physics Division, NSRFC
Mr. D. H. McKeough
Chairman of the Board, Ferguson Industries Limited
Mr. D. H. Covill
President, Nautical Electronic Laboratories Limited

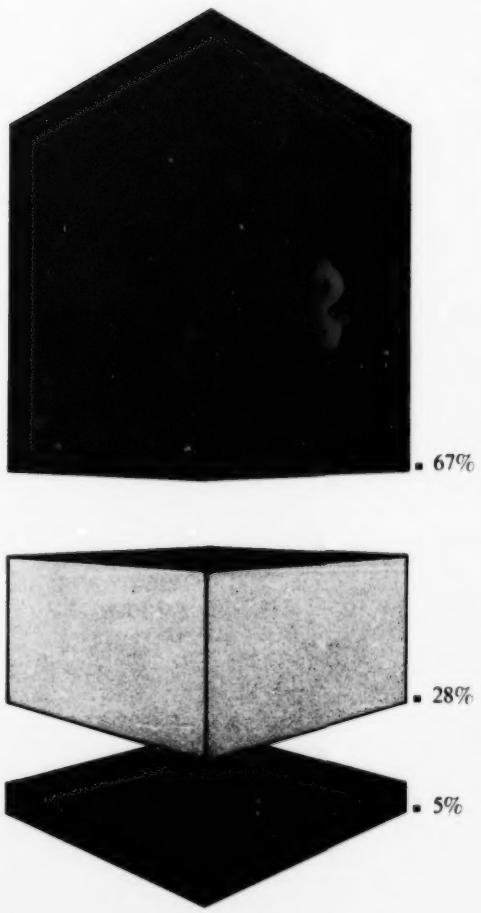
Magnetically coupled blower

The following Corporation personnel are the Officers of Nova Magnetics Limited:
Dr. J. E. Blanchard
President
Mr. C. R. Tyner
Vice-President and General Manager
Mr. J. A. Gillis
Vice-President, Marketing
Mr. T. B. Nickerson
Vice-President, Finance
Mr. R. F. MacNeill
Secretary/Treasurer

Revenue Overview

Source of Revenue 1981/82

Contracts	67%
Grant — Province of N.S.	28%
Investment Income	5%

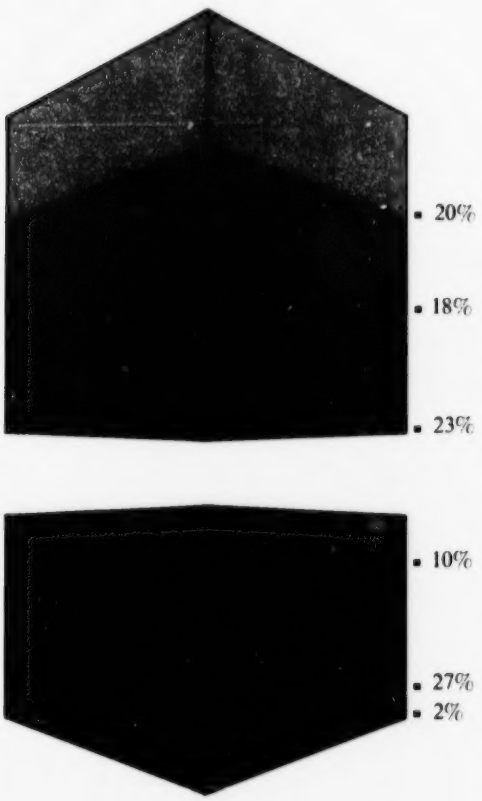


Source of Contracts 1981/82

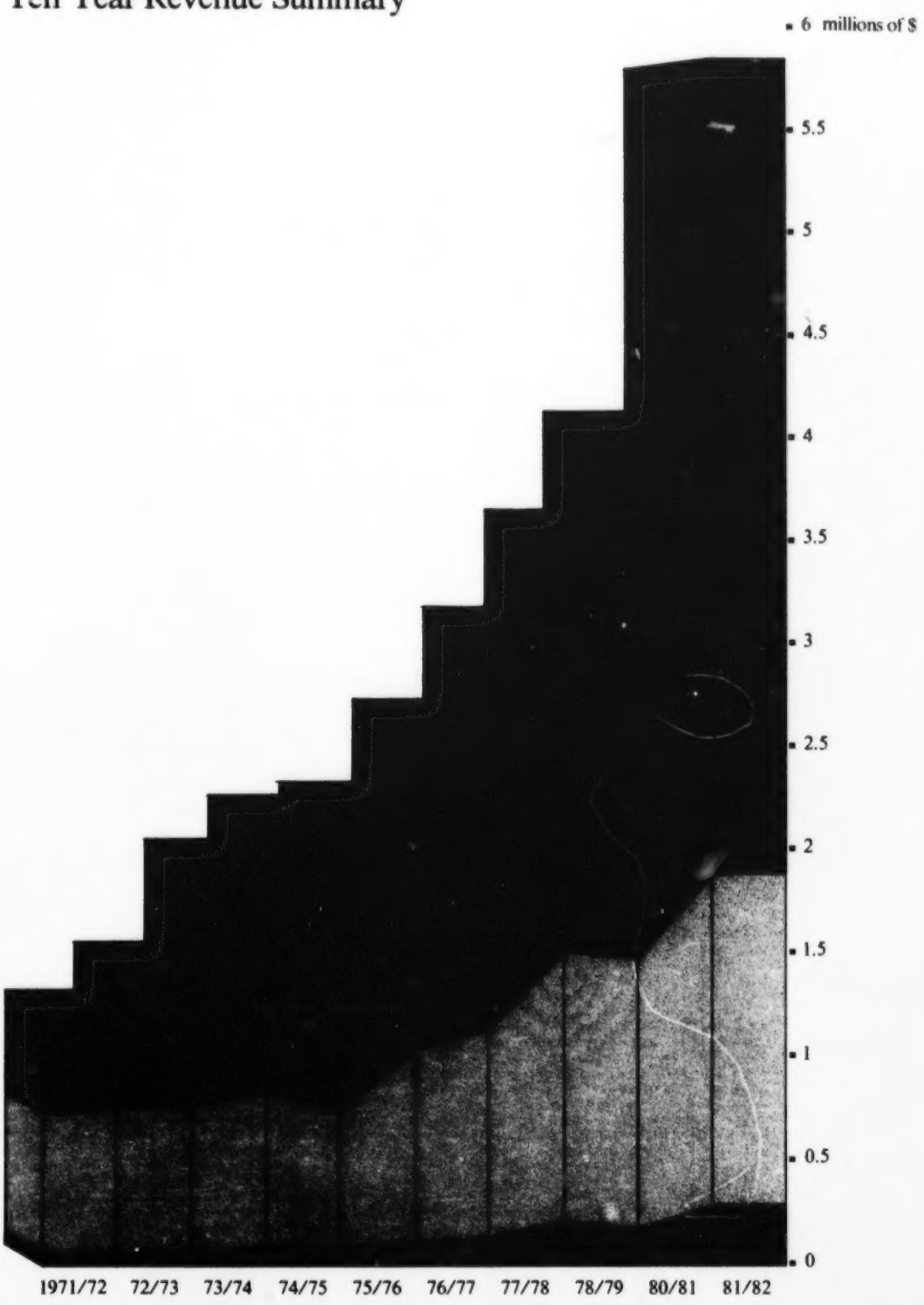
(by $ value)

Industry*		61%
Nova Scotia	20%	
Rest of Canada	18%	
Foreign	23%	
Government		39%
Nova Scotia	10%	
Federal	27%	
Foreign	2%	

*Includes Crown Corporations



Ten Year Revenue Summary



Financial Statement

Nova Scotia Research Foundation Corporation
Balance Sheet as at March 31, 1982

Assets		1982	1981
Current	Cash	**$ 109,490**	$ 24,681
	Accounts receivable	**928,985**	745,289
	Short-term investments	**1,207,085**	631,593
	Inventory (Note 1)		
	Supplies	**200,836**	51,931
	Equipment for resale	**—**	145,798
		2,446,396	1,599,292
Research Endowment Fund	Province of Nova Scotia 8¼% Bond, maturing November 26, 1982	**1,000,000**	1,000,000
Capital Building Fund (Note 2)	Short-term investments	**—**	400,205
Fixed (Note 1)	Land and buildings	**2,843,267**	2,730,965
	Equipment	**1,296,122**	1,167,085
		4,139,389	3,898,050
		$7,585,785	$6,897,547

Liabilities and Equity			
Current	Accounts payable		
	Trade	**$ 339,391**	$ 352,378
	Province of Nova Scotia	**1,112,393**	513,317
	Deferred revenue	**56,162**	96,239
		1,507,946	961,934
Research Endowment Fund	Fund balance	**1,000,000**	1,000,000
Capital Building Fund (Note 2)	Accounts payable	**—**	278,979
	Fund balance	**—**	112,226
		—	400,205
Equity	Capital Equipment Reserve (Note 3)	**111,038**	—
	Contributed surplus (Note 1)	**4,139,389**	3,898,050
	Retained earnings	**827,412**	637,358
		5,077,839	4,535,408
		$7,585,785	$6,897,547

Auditor's Report

To the Board of Directors

I have examined the balance sheet of the Nova Scotia Research Foundation Corporation as at March 31, 1982 and the statement of revenues and expenses and the statement of retained earnings for the year then ended. My examination was made in accordance with generally accepted auditing standards and accordingly included such tests and other procedures as I considered necessary in the circumstances.

In my opinion, these financial statements present fairly the financial position of the Corporation as at March 31, 1982 and the results of its operations for the year then ended, in accordance with generally accepted accounting principles, except for the method of accounting for fixed assets, as referred to in Note 1 to the financial statements, applied on a basis consistent with that of the preceding year.

A. W. SARTY
Auditor General
Halifax, Nova Scotia
July 2, 1982

Notes to Financial Statements

1. Accounting Policies

A) Inventory

Supplies are valued at the lower of cost and net realizable value.

Nova Scotia Research Foundation Corporation
Statement of Revenues and Expenses For the Year Ended March 31, 1982

		1982	1981
Revenues	Scientific and engineering	**$3,783,143**	$2,511,550
	Grant from Province of Nova Scotia	**1,600,000**	1,300,000
		5,383,143	3,811,550
Expenses	Scientific and engineering	**4,312,904**	3,308,827
	Administrative and occupancy	**1,070,258**	719,078
		5,383,162	4,027,905
	Excess of expenses over revenues before investment income and other revenue	**(19)**	(216,355)
Investment Income	Research Endowment Fund	**82,500**	82,500
	Short term investments	**218,611**	106,802
		301,111	189,302
		301,092	(27,053)
Other Revenue	Proceeds on sale of Geophysics deep tow system previously capitalized	**—**	140,000
	Excess of revenues over expenses	**$ 301,092**	$ 112,947

Nova Scotia Research Foundation Corporation
Statement of Retained Earnings For the Year Ended March 31, 1982

	1982	1981
Balance, beginning of year	**$ 637,358**	$ 524,411
Add excess of revenues over expenses	**301,092**	112,947
	938,450	637,385
Less transfer to Capital Equipment Reserve (Note 3)	**111,038**	—
Balance, end of year	**$ 827,412**	$ 637,358

B) Fixed Assets and Related Contributed Surplus

Fixed assets are acquired by purchase and by donation.

When fixed assets are acquired out of the general revenues of the corporation they are charged to expense in the year of acquisition. For record purposes the cost of all fixed-asset additions, whether by purchase or donation, are set up in the fixed-asset account, with an offseting credit to contributed surplus.

When fixed assets are constructed by the Corporation the related material, labour and overhead costs are included as fixed assets in the year of expenditure.

When equipment is ten years old, the cost is removed from both the fixed-asset and contributed surplus accounts.

2. Capital Building Fund

The building addition was completed during the year and the disposition of the capital building fund was as follows:

Balance, April 1, 1981	$112,226
Interest earned	76
	112,302
Building addition costs during the year	112,302
Balance, March 31, 1982	$ —

3. Capital Equipment Reserve

In anticipation of capital equipment purchases, at significantly higher costs in future years, the Corporation has set up a Capital Equipment Reserve by appropriations from Retained Earnings.

Accordingly for the current year, an amount of $111,038 has been transferred from Retained Earnings to the Capital Equipment Reserve.

4. Wholly Owned Corporation

During the year the Corporation set up a wholly owned subsidiary, Nova Magnetics Limited, to develop the commercial potential of magnetic couplings. The company was incorporated on May 1, 1981. As of March 31, 1982 it had not commenced commercial production but it had incurred start up and promotional costs of $21,766. These costs were paid for by the Corporation and are included among its accounts receivable at year end. In addition, the Corporation has agreed, as of April 1, 1982 to make a demand loan of $100,000 to Nova Magnetics Limited for working capital purposes.

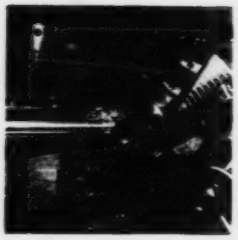
Other Services & Administration

Glass Blowing

Glass Blowing services are provided for industry and research laboratories in Atlantic Canada. Repair of milking jugs, construction of vacuum distillation rigs and repair or modification of laboratory glassware are a few examples of work undertaken.

Glassblower
R. Maxwell

Instrument Shop



The well-equipped shop works with the Corporation's scientists and engineers to turn product designs into first prototypes for testing, evaluation and modification. Normally, any repeat requirements for hardware are contracted out to local industry.

Shop supervisor
C. E. Isenor

Machinists
A. B. Johnson
L. R. Hartlen
D. W. Haskins
R. A. Marks

Administration

President
J. E. Blanchard,
B.Sc. (Dal.), M.A., Ph.D. (Tor.), F.R.S.C.

Vice-President
T. B. Nickerson,
B.Eng. (Acadia, N.S.T.C.), M.Sc. (Birm.), P.Eng.

Secretary to the President
N. J. Gerogiannis

Consultants
R. H. Magarvey,
B.Sc. (Acadia), M.Sc. (McGill), D.Sc. (Acadia)
H. D. Smith,
B.A., M.A. (U.B.C.), M.A., Ph.D. (Tor.), D.Sc. (Acadia, St. F.X.)
C. N. Kennedy
P. N. Taiani

Manager of Administration
R. F. MacNeill,
B.Sc., B.Comm. (S.M.U.)

Accounting
K. J. Hornsby
R. Chaffey
E. M. Marr
H. Pelton

Building Services
G. E. Fraser
J. F. Brown
M. Crawford
G. E. Dean
W. Jodrey
D. K. Julien
E. W. M. H. Maessen
L. J. Mannette
L. Merrigan
H. Parusel
R. Reid
F. Walsh

Carpentry Shop
R. C. Fraser
J. E. Mailman

Purchasing & Shipping
W. G. LeRue
J. M. Foster
J. Pelton

Support
S. J. Drover
B. Gandhu
B. Oldfield
C. E. Sutherland

Advisory Committee

Advisory Committee Centre for Ocean Technology

Dr. J. E. Blanchard
(Chairman)
President
Nova Scotia Research Foundation Corporation

Mr. J. Brooke
Industrial Liaison Officer
BIO Marine Advisory and Industrial Liaison Office
Bedford Institute of Oceanography

Dr. O. Cochkanoff
Dean of Engineering
Technical University of Nova Scotia

Mr. D. H. Covill
President
Nautical Electronics Laboratories Limited

Mr. M. A. Eisenhauer
President
ABCO Limited

Mr. F. A. A. Ferguson
Director
Defence Research Establishment Atlantic

Mr. I. H. Langlands
Vice-President, Development
National Sea Products Limited

Mr. A. Levin
Halifax, Nova Scotia

Mr. R. A. Reynolds
Science Advisor
Department of Industry, Trade and Commerce

Mr. G. A. J. Smith
Manager of Engineering
Hermes Electronics Limited

Mr. C. R. Tyner (Secretary)
Director
Centre for Ocean Technology
Nova Scotia Research Foundation Corporation